There seems to the present writer to be no evidence whatever for such a conclusion; but the truth appears to be that the normal direction of the upper current during the hurricane season, as at all other times, is from a westerly point, and that any deviation from this rule is to be lookt upon not as a mere freak, or accident, but as a phenomenon to be traced to a definite cause—that cause being, at all events in some cases, the presence and progress of a cyclonic depression.

Since writing the article to which the above remarks are offered as supplementary, we have had in the West Indies another hurricane season, and, altho no hurricane has occurred among the islands, we have seen here in St. Croix, during the season, no less than eight deviations of the high clouds from their usual course. Some of these were thru south round to the northeast quadrant, indicating perhaps, distant storms on the Atlantic, passing to the north of these Danish Islands; while others were thru north round to the above-named quadrant and indicated, it may be, storms originating in the Caribbean and passing northward.

So far there is very little evidence to connect any of the deviations, or "excursions", as we may perhaps call them, with cyclonic depressions.

The last three occurred in the latter part of September and in October; each was attended by a small fall in the barometer, and each October movement gave a little rain to St. Croix, on the 10th and 20th, respectively.

These three "excursions" are dealt with in the local newspaper (St. Croix Avis) of October 30 in the following article by the writer, which may serve to close the present paper:

Those of our readers who take an interest in weather studies will remember that in the last number of this paper we spoke of three excursions which the point of origin or radiating point of the high clouds had made from its normal position about west into the northeast quadrant, one in September and two in October. They were as follows:

1. The first excursion—commencing from southwest by west, going round to northeast, and lasting from the 23d to the 29th of September.

2. The second excursion—commencing from south-southwest on the 8th (with a temporary excursion to south-southeast) and going round to northeast by north, and lasting from the 8th to the 18th of October.

3. The third excursion—commencing from west-southwest and going round to northeast by north, and lasting from the 19th to the 25th of October.

From earlier comparisons of high cloud observations with the known and mapped out tracks of certain cyclones, we believe that each of these three excursions means the origin of a cyclone in the Caribbean, its subsequent passage from that sea to the Atlantic, and its farther movement in a northerly direction over that ocean. Sometimes there are excursions in the other direction, namely, round through south and east, but we need not consider them here.

But how are we to know that these swings of the radiating point of the high clouds through north round to northeast have the meaning ascribed to them. Evidently we can only come at it by finding out whether there were any actual cyclones answering to the theoretical description. In each of the three cases now under consideration the movement appears to have been of no great importance before or at the time of leaving the Caribbean, for we have heard of no storms among the islands to the west of us; if there were any, they were not of sufficient force to be destructive, or at all events not to any degree that was thought worth reporting. They entered the Atlantic quietly, but it remains to enquire whether they were developed there. From the duration of the high cloud excursions, and the radiating point going round as far as northeast, we should infer that in each case considerable energy was developed as the cyclone traveled northward, but what evidence is there to show that such was the fact. About the third one we have as yet no confirmatory tidings; but it is now (on the 29th) only four days since the influence of this movement on the high clouds here ceased, so the case may fairly claim a little delay. We deal therefore with the evidence for the *first* and *second* excursions.

1. Evidence bearing on the first excursion. In the Avis of Saturday last (26th instant) we adduced the case of the schooner *Carrie E. Bucknam*, which on the 1st of October, in latitude 37° 44′, with a gale blowing from northwest, appears to have had a cyclone center to the northeast of her. To-day we are able to bring what looks like fairly good evidence that a powerful cyclone passed up the Atlantic during the high cloud excursion which we now have under consideration. The New York Herald of the 1st of October gives some account of a storm which endangered the Atlantic fleet at Cape Cod on the night of the 29th of September. It was a gale from the east. That it was part of a cyclone is evident from the reference to the fact that storm signals had been hoisted; and it seems likely that the cyclone did not come off the continent, but up the Atlantic, for a short paragraph in the same paper speaks of the fears of the Navy Department for the safety of the seagoing tug *Lebanon* and the *Gloucester*, which were on their way from Pensacola, Fla., to the Navy Yard at Portsmouth, N. H., where the *Gloucester* was to be repaired.

Cape Cod is in latitude 42°. In the September cyclone of last year the storm center had reached about latitude 32° when its hold on the high clouds here was given up. Cape Cod is much (say nearly 700 miles) farther away; but then we must remember that the storm center was not at Cape Cod, but some distance south of it, and that it may have been moving very fast toward the north.

From all which it appears that, while the evidence looks very promising, we can not make proper comparisons or make sure of the case till we get further details, which may possibly come to hand later.

2. Evidence in regard to the second excursion (the first in October). In this case we have as yet only one piece of evidence, namely the experience of the *Guiana* on her recent trip from New York. The steamer left New York at 6 p. m. on Saturday the 12th instant to come south; about the same time, or perhaps on the previous day, the cyclone left the Caribbean to go north. If they should pass each other it would not be surprising. Accordingly, Tuesday night was rough. A gentleman who was one of her passengers informed us that he came on deck very early on Wednesday morning and observed three things, a strong wind from southwest, a considerable sea rolling in from southeast, and a dense bank of clouds toward the northeast. The barometer had dropped to 29.60 and the steamer had been slowed down a little during the night. We can see at once that a cyclone with its center some distance to the west of the steamer (100 or 200 miles, perhaps) had passed during the night. When in the morning the wind was southwest, the center was away to the northwest. The sea which came rolling in from the southeast had no doubt been raised by the wind in the cyclone's northeast quadrant, and the clouds to the northeast had been carried there by the southwest wind. As the steamer came south the conditions became rapidly better till she was once more sailing in fine weather.

Thus it will be seen that there is some evidence to confirm the theoretical views about excursions numbers one and two, and we may hope to get more later. For any confirmation in regard to excursion number three we must, as already intimated, wait a little longer.

A METHOD OF PRESERVING RAINFALL.

By J. CECIL ALTER, Assistant Observer. Dated Salt Lake City, Utah, November 4, 1907.

On April 16, 1907, I placed 0.20 inch of pure olive oil on 0.20 inch of water in the regulation Weather Bureau pattern 8-inch rain gage—with the funnel receiver, but without the inner tube—and exposed the gage in the regular support alongside the tipping-bucket gage. On November 3, 1907, I measured the contents of the gage, which amounted to 7.77 inches after deducting for the oil and the original water supporting the oil. The records in the office, obtained from the tipping-bucket gage during the same period of time, indicated a total precipitation of 8.03 inches—a discrepancy of 0.26 inch, or about 3 per cent, which was probably caused in part by evaporation; for after light showers, which are so frequent here, many tiny drops of water have been observed to lie sustained on the oil for a considerable length of time before sinking.

This experiment has been carefully made, and the results may be useful in solving the problem of obtaining records of precipitation in the unpopulated regions of the West.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

Baden. Zentralbureau für Meteorologie und Hydrographie.

Deutsches meteorologisches Jahrbuch. 1906. Karlsruhe. 1907. 75 p. f°.

Jahres-Bericht... 1906. Karlsruhe. 1907. 116 p. f°.

Birkeland, B. J.

Neue Feuchtigkeits-Tafeln für das Psychrometer unter dem Gefrierpunkt. Christiania. 1907. 33 p. 4°.

Budapest. Observatoire sismique.
Rapport annuel sur les observatoires sismiques des pays de la Sainte Couronne de Hongrie. Budapest. 1907. 11 p. 8°.

Dellenbaugh, Frederick S.
The romance of the Colorado river. xxxv, 399 p. 8°.

Great Britain. Meteorological office.
Hourly readings obtained from the self-recording instruments at four observatories in connection with the Meteorological office, 1906. London. xiii, 197 p. f°.

Hérault. Commission météorologique.
Bulletin météorologique. Année 1906. Montpellier 1907. 128 p. 4°.

Hesse. Grossherzogliche hydrographische Bureau.
Deutsches meteorologisches Jahrbuch... 1906. Darmstadt. 1907. [13], 59 p. f°.

Hoyt, John Clayton and Grover, Nathan Clifford.
River discharge. New York. 1907. vii, 137 p. 8°.

Milham, Willis I.
Cloud classification. 9 p. 8°. Williamstown. 1907.

Riefler, S.
Die Uhrenanlage der Hauptstation für Erdbebenforschung am physikalischen Staatslaboratorium zu Hamburg. Laibach. 1907. 12 p. 8°.

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

American society of civil engineers. Proceedings. New York. v. 33. Dec., 1907.

Bruyn-Kops, J. de. Notes on rainfall at Savannah, Ga. p. 1101–1110. [Includes tabulation of all cases of excessive rainfall at Savannah, Ga., 1889–1906, inclusive.]

Electrical world. New York. v. 50. Dec. 7, 1907.

—— Lightning protection. p. 1083–1084. [Describes recent forms of lightning arrestors.]

Geographical journal. London. v. 30. Dec., 1907.

Woosnam, R. B. Ruwenzori and its life zones. p. 616–629. [Includes notes on the climate.]

Nature. London. v. 77. Dec. 12, 1907.

—— Experiments on wind pressure. p. 139–140. [Abstract of paper by T. E. Stanton.]

Royal society. Proceedings. London. Series A. v. 80. No. A 535.

Schuster, Arthur. The diurnal variation of terrestrial magnetism. p. 80–82.

Science abstracts. London. v. 10. Nov., 1907.

W[ilkinson], A. Air resistance. [Abstract of article by Joubet.] p. 567.

B[orns], H. Indian Ocean meteorology and the southwest monsoon. [Abstract of article by C. W. Brebner.] p. 590.

Scientific American supplement. New York. v. 64. Dec. 14, 1907.

—— Preventing frost on show windows. Cold-weather advice. p. 375.

—— Electric waves in the service of meteorology. [Abstract of paper by Guillén-Garcia describes the use of thunderstorm recorders in forecasting.] p. 382–383.

Stentzel, Arthur. The climate of Mars. Its effect on the habitability of the planet. p. 383.

Aérophile. Paris. 15 année. Nov., 1907.

Tatin, Victor. Les oiseaux, les aéroplanes et le coefficient de la résistance de l'air. p 309–312.

Soubies, Jacques. Physiologie de l'aéronaute. p. 316–317. [Abstract.]

Nature. Paris. 36 année. 14 déc., 1907. Supplement.

—— L'argon de l'air atmosphérique. p. 9. [Note on new method of extracting argon and the other rare gases of the atmosphere.]

Journal de physique. Paris. 4 série. Tome 6. Nov., 1907.

Trovato-Castorina, G. Sur la direction des décharges électriques atmosphériques dans les coups de foudre. p. 928. [Abstract.]

Meteorologische Zeitschrift. Braunschweig. Bd. 24. Nov. 1907.

Jaerisch, Paul. Zur Theorie der Luftdruckschwankungen auf Grund der hydrodynamischen Gleichungen in sphärischen Koordinaten. p. 481–498.

Teisserenc de Bort, Léon. Ueber dei Verteilung der Temperatur in der Atmosphäre am nördlichen Polarkreis und in Trappes. p. 498–499.

Hann, J. M. E. Stephan über Temperatur, Regen und Winde von Marseille. p. 500–501.

Hann, J. Die äquivalente Temperatur als klimatischer Faktor. p. 501–504.

Trabert, Wilhelm. Eine mögliche Ursache der geringen Temperaturabnahme in grossen Höhen. p. 504–506.

Nippoldt, A. Vorläufige Ergebnisse der magnetischen Landesaufnahme von Baden, Hessen und Elsass-Lothringen. p. 506–508.

Hann, J. Osc. V. Johansson: Ueber die anemometrischen Windstärkemessungen in Finland. p. 508–509.

Hann, J. R. Strachan über die Temperatur um die britischen Inseln in Beziehung zum Golfstrome. p. 509–511.

H[ann], J. A. Defant über den Talwind des Unterinntales. p. 511.

Schmidt, Wilhelm. Ueber Messungen der terrestrischen Refraktion auf dem hohen Sonnblick. p. 512–514.

Macdowall, Alex. B. Sonnenflecken und Regenfall zu Rothesay (Schottland) 1804 bis 1904. p. 514.

Hann, J. Der tägliche Gang der Temperatur in den Vereinigten Staaten. p. 514–515.

H[ann], J. Zum Klima von Porto Rico. p. 515–516.

—— Dr. L. Grossman über die Veränderlichkeit der Temperatur von Tag zu Tag an der deutschen Küste 1890–1899. p. 516–518.

Exner, F. M. W. N. Shaws Untersuchungen über die Lebensgeschichte von Luftströmungen an der Erdoberfläche. p. 520–523.

H[ann], J. Zum Klima von Finnland. p. 523.

Naturwissenschaftliche Rundschau. Berlin. 22 Jahrgang. 5 Dez., 1907.

Messerschitt, J. B. Die erste Generalversammlung der internationalen seismologischen Assoziation im Haag vom 21. bis 25. September 1907. p. 626–628.

Petermanns Mitteilungen. Gotha. 53. Band, 1907.

Halbfass, —. Apparat von Schnitzlein zur selbsttätigen Aufzeichnung von Wasserständen. p. 241–242.

Physikalische Zeitschrift. Leipzig. 8 Jahrgang. 15 Nov. 1907.

Linke, F. Ueber die Arbeiten des Samoa-Observatoriums. p. 871.

Börnstein, R. Zur Geschichte der hundertteiligen Thermometerskala. p. 871–874. [Inversion of the Celsius scale attributed to Linné.]

Herrmann, E. Ueber tatsächliche vieltägige Perioden des Luftdruckes. p. 874–879.

Zeitschrift für Instrumentenkunde. Berlin. 27 Jahrgang. Nov., 1907.

Sprung, A. Eine Vereinfachung des Gallenkampschen Regen-Auffangapparates. p. 340–343.

Netherlands. Koninklijk Nederlandsch meteorologisch Instituut. Mededeelingen en verhandelingen. No. 102.

Gallé, P. H. Cyclone in the Arabian Sea. October 18–November 4, 1906. 8 p.

Societa degli spettroscopisti italiani. Memorie. Catania. v. 36. 1907.

Lo Surdo, Antonino. Il nuovo metodo di Knut Angström por lo studio della radiazione solare. p. 192–197. [Abstract.]

STUDIES OF FROST AND ICE CRYSTALS.

BY WILSON A. BENTLEY. Dated Jericho, Vt., May 28, 1906. Revised July, 1907.

(Continued from October Review.)

VIII.—CLASSIFICATION OF ICE CRYSTALS.

(67) List of types.

There are at least five different and characteristic types among the nuclear or germ ice crystals, and two or three additional post-nuclear types. In general, if growth is allowed to proceed for a sufficient length of time, each of these various germ types passes thru certain typical and characteristic growth phases peculiar to it. All, or nearly all, when first organized, possess smooth edges and contours, but they subsequently pass thru the scalloped, the ray, and the branch-like stages of growth before completion. These various types, because of peculiarities of form and resemblance to the objects after which they are named, may be grouped and named as follows:

1. Lanceolate ..... Lance-like, MLA.
2. Discoidal ..... Disc-like, MDB.
3. Solid hexagonal ..... Solid hexagonal plate-like, MHC.
4. Flower-like ..... Ice flower-form, MFD.
5. Spandrelliform ..... Resembling a spandrel, MSE.
6. Coralline ..... Resembling coral, MCF.

Each of these respective types requires and will receive especial mention by itself in the text, in the order of relative frequency of occurrence of each in nature, so far as I have observed them at Jericho, Vt.

(68) Type MLA. Lanceolate ice crystals.

These lance-like or needle-like crystals are illustrated in